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CONTENTS

FIELD EXPERIMENT VERSUS LABORATORY EXPERIMENT ON ODOURS AND MEMORY

Generally, memory retrieval is improved if recall occurs in the same room as learning. This was established through laboratory experiments by Steven Smith (eg: Smith 1979).

Specifically, words or pictures learned in the presence of a distinctive odour are recalled better in the presence of the same odour than a different one or no odour at all in laboratory experiments (eg: Cann and Ross 1989).

Cann and Ross (1989) asked sixty-three male psychology undergraduates to rate the attractiveness of fifty pictures of female students in a room containing a pleasant odour (cologne) or an unpleasant one (ammonium sulfide). Two days later, in a different room, the participants had a recognition test of the faces in the presence of the same or an alternative odour. A control group also did the experiment with no odours present at either learning or recognition. There were five conditions to the experiment, and recall was better when the odour was the same at learning and recall (table 1).

ODOUR AT: LEARNING	RECALL	MEAN RECOGNITION SCORE (out of 50)
pleasant	pleasant	18.50
unpleasant	unpleasant	18.58
pleasant	unpleasant	17.96
unpleasant	pleasant	17.54
none	none	16.62

Table 1 - Conditions and results of laboratory experiment by Cann and Ross (1989).

FIELD EXPERIMENT BY AGGLETON AND WASKETT (1999)

Aggleton and Waskett (1999) set out to confirm the finding that recall is better in the presence of the same odour as at learning in a field experiment at Jorvik Viking Centre in York. A field experiment is an experiment performed outside the laboratory, and it has higher ecological validity (ie: applicability of results to real-life situations). Table 2 compares the advantages of field and laboratory experiments.

The Jorvik Museum attempts to recreate the city of York during Viking occupation in the 10th century. This includes the piping of seven distinctive odours into the

FIELD EXPERIMENT	LABORATORY EXPERIMENT
1. Higher ecological validity. 2. Certain topics cannot be	1. Greater control over variables and participants.

Table 2 - Advantages of field and laboratory experiments.

museum (burnt wood, apples, rubbish acrid, beef, fish market, rope/tar, and earthy). Visitors are taken around part of the museum in vehicles, and this controls the order of sights, sounds and smells. This is important because the field experiment is criticised for lacking the control over variables that laboratory experiments have.

Other variables that needed controlling included interval between visits, age at time of visit, and total number of visits made to the museum.

Method

There were three experimental groups, each containing fifteen participants. Half of the sample were undergraduates from the university of the researchers (Cardiff university), and the remainder were recruited at the museum. The length of time since the last visit to the museum was 6.7 years on average.

The accuracy of memory was measured by twenty questions about displays at the museum which participants filled in twice, with a gap of five minutes, in the presence of odours or not as per each condition.

The experiment involved the seven odours from Jorvik contained in seven bottles, and seven control odours not found at Jorvik (coffee, peppermint, rose, antibacterial cleaner, coconut, maple, and rum). Participants were asked to smell the bottles before answering the memory questions.

Technically, the design of the experiment was independent groups and repeated measures together [1]. The "single-cue comparison method", used in laboratory experiments, which compares odour versus no odour, had the problem of large individual differences within the groups. Thus the use of the "double-cueing" methodology (Chu and Downes 2000).

Table 3 lists the three conditions of the experiment.

GROUP	A: FIRST COMPLETION OF	B: SECOND COMPLETION

[1] This type of design was used by Tulving and Bower (1974) in a laboratory memory experiment.

	MEMORY TEST	OF MEMORY TEST
1	Jorvik odours	control odours
2	control odours	Jorvik odours
3	no odours	no odours

Table 3 - Details of the three conditions in Aggleton and Waskett (1999).

The design of the experiment allowed a comparison of recall depending on odour cues or not on both completions of the memory test (independent groups design). It was predicted that if having the same odours present at retrieval as at learning (first visit to museum), group 1 should have better recall than groups 2 and 3 at completion A of questionnaire, but group 2 would do better at completion B.

The repeated measures aspect of the experiment allowed the researcher to compare the individual's memory performance in response to two sets of odour cues.

The repeated measures design was included to control for individual differences like length of time since original visit to museum and age at first visit.

Findings

Table 4 shows the group means for accuracy of recall of information about Jorvik Viking Centre.

GROUP	COMPLETION A	COMPLETION B
1	10.9 *	11.1
2	9.0	10.7 *
3	9.6	10.3

(* = Jorvik odours)

Table 4 - Mean recall scores (out of 20) for each group and completion of the memory test.

There was no significant difference in recall between the groups on either completion of the memory questionnaire [2]. All groups showed improvement between the first and second completion of the test, but group 2 showed a significant improvement. Thus the Jorvik odours clearly acted as a retrieval cue to aid memory.

The findings fit with the "encoding specificity principle" (Tulving and Thomson 1973). This proposed that

[2] The results may not have been significant because of the large variation in memory performance between individuals (Chu and Downes 2000).

when information is encoded, other details are included in the memory like the environment in which learning took place. These details act as contextual cues to aid retrieval. In this case, odours were encoded with information about the museum's exhibits.

Odours, particularly unpleasant ones like the "rubbish acrid" one, produced an emotional arousal, and this can also aid recall through the activity of the amygdala (Cahill et al 1995).

EVALUATION OF AGGLETON AND WASKETT (1999)

The Aggleton and Waskett (1999) field experiment has a number of advantages and disadvantages, particular in relation to past laboratory experiments on smell and memory.

Advantages

1. Most laboratory studies are short-term (eg: 48 hours; Cann and Ross 1989) between learning in the presence of an odour and recall in the presence of the same or a different odour. Aggleton and Waskett tested memory over the long-term (mean: 6.7 years), which is difficult in a laboratory experiment.

2. In laboratory experiments individuals know that they are being studied, and participants may concentrate harder to learn the material. This is an example of "demand characteristics" (Orne 1962) where participants change their behaviour to what they think the experimenter wants [3].

Aggleton and Waskett used past visits to the museum as the learning phase, and individuals could not have known that their memory would be tested at a future data.

3. High ecological validity - testing memory as used in real life. Brunswick (1947) coined the term "ecological validity" to mean the "appropriate generalisations from the laboratory to non-experimental situations" (Orne 1962).

4. Attempted to control for differences in length of time since last visit, for example, by including both

[3] Some researchers have argued that participants are either not changing their behaviour to please the experimenter but themselves (eg: "evaluation apprehension"; Weber and Cook 1972) or changing their behaviour in the direction opposite to expected (eg: the "screw you" effect; Masling 1966).

independent and repeated designs (table 5).

ADVANTAGES	DISADVANTAGES
1. Comparison between groups and comparison between individuals.	1. Risk of order effects with repeated measures.
2. Control for individual differences with repeated	2. No guarantee that groups are similar with independent groups

Table 5 - Advantages and disadvantages of combining independent groups and repeated measures designs.

5. The nature of the material to remember was different to that in laboratory experiments. Aggleton and Waskett used a questionnaire about Viking life as seen in the museum: "the types of clothing and jewellery worn by Vikings, the type of food eaten, the nature of the buildings and the classes of items sold in Viking York" (p3). Four of the twenty questions were multiple choice type.

In a laboratory experiment, Smith et al (1992) used 24 words to recall (12 pleasant, 12 unpleasant), which is typical of memory experiments but low in ecological validity. The Cann and Ross (1989) study was better in this respect using photographs of female students from the university yearbook.

6. Aggleton and Waskett were able to get closer to testing "true" autobiographical memories. Laboratory experiments control what is to be remembered rather than allowing the individual to freely recall memories. Though Aggleton and Waskett were testing recall of information about the museum, individuals were allowed some flexibility to recall their own choice of autobiographical memories. This study was able to partly bridge the gap between experimental studies of memory and studies of autobiographical memory.

The study of autobiographical memory focuses upon how individuals form their own personal memories over the lifespan. It is not necessarily concerned with accuracy of recall as in memory experiments. In autobiographical memory researchers have studied the "Proust phenomena" in relation to odour and memory.

The "Proust phenomena" is "the ability of odours spontaneously to cue autobiographical memories which are highly vivid, affectively toned and very old" (Chu and Downes 2000 p111).

7. Aggleton and Waskett assumed that odour recognition

worked over a long period of time. In the short-term, visual recognition is better than odour recognition (Chu and Downes 2000), but Engen and Ross (1973) found, over an interval of one year, the opposite was true.

8. Aggleton and Waskett re-analysed their data when the results did not show significant differences and removed answers to questions that could have influenced this. For example, answers to two questions were removed where recall might have been aided by "direct cueing" (ie: the name of one of the odours in the question). This did not alter the overall findings.

Disadvantages

1. The Aggleton and Waskett sample size was limited (n = 45) [4], of which about half were undergraduates. Along with the volunteers at Jorvik, the average age of participants was in the 20s.

The sample was also volunteers, and individuals who volunteer are not necessarily typical of the general population (Brewer 2005). This does limit the generalisability of the findings.

2. The participants filled in the memory questionnaire twice with only a short break (five minutes) between them. This risks fatigue or boredom as well as a natural improvement (known as order effects). All groups scored higher on the second questionnaire. It would have been better to leave a longer gap before the second completion of the memory questionnaire.

3. The control odours were smells not found at Jorvik, and were meant to be neutral. But they may have triggered strong personal memories and thereby interfered with recall about the museum.

However, recall was not much worse with the control odours compared to the Jorvik odours.

It would have been interesting to include control groups with no odour in one completion of the memory questionnaire and odour in the other (table 6).

4. This study did not find a significant difference between recall in the presence of the same odours as

	Completion A	Completion B

[4] This is similar to laboratory experiments - 63 participants (Cann and Ross 1989) and 47 participants (Smith et al 1992).

no odour	Jorvik odour
no odour	control odour
control odour	no odour
Jorvik odour	no odour

Table 6 - Possible other control groups for Aggleton and Waskett.

learning compared to no odours. Laboratory experiments have found such differences.

For example, Smith et al (1992) found a significant difference ($p<0.01$) when they compared recall of a list of 24 words by university students in the presence of the same or a different odour as during learning. The mean number of words recalled for the same odour was 19.1 (incense) and 21.8 (perfume) compared to 17.7 (incense-perfume) and 16.8 (perfume-incense) for different odours.

5. Aggleton and Waskett used two sets of seven different odours whereas laboratory experiments tend to use one odour per condition. Perfume and jasmine incense were the only odours used by Smith et al (1992), while Cann and Ross (1989) used either cologne or ammonium sulfide.

Participants in the Jorvik study controlled the odours by smelling from the bottles of odours prior to answering the questionnaire. In the laboratory experiments, the experimenters control the odours. Smith et al burnt a stick of incense for five minutes before the participants arrived or sprayed 2 ml of perfume around the room. For Cann and Ross, the unpleasant odour (ammonium sulfide) was left in a dish hidden on a shelf.

6. Aggleton and Waskett did not measure the emotional response to the odours, which may have influenced recall. For example, Herz and Cupchik (1995), in a laboratory experiment, paired emotional paintings with certain odours or odour labels (ie: words) at learning. When presented with odours or labels later, the former produced more emotion toned information about the paintings than with words.

While Herz (1997) found that distinctive odours that were inappropriate to the situation at learning produced best recall in the retrieval condition.

7. it was proposed by Aggleton and Waskett that odour cues improved recall through the action of the amygdala, but the exact mechanism involved is not clear (Chu and Downes 2000).

8. Laboratory experiments can guarantee what the

participants are presented with. Smith et al (1992), for example, presented participants with all twenty-four words on separate white cards for six seconds each.

Whereas Aggleton and Waskett could never be sure that their participants saw the relevant exhibits for the memory questionnaire.

Comparison of Laboratory and Field Experiments

Table 7 summarises the key differences in methodology between Aggleton and Waskett's study and two laboratory experiments on odour and memory.

	Aggleton and	Smith et al	Cann and Ross
Type of	Field	Laboratory	Laboratory
Number of	3	4	5
Design	Independent groups and repeated	Independent groups	Independent groups
Time between learning and	average 6.7 yrs	48 hrs	48 hrs
No of odours	7 Jorvik; 7	2	2
Control group -	yes	no	yes
Recall task	20 questions about museum	24 words	50 black and white photographs of female faces to recognise out of 100
Sample and size	45; about half undergraduates; about half visitors to	47 university students	63 male psychology undergraduates

Table 7 - Key methodological differences between three studies.

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Kevin Brewer

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CONTENT ANALYSIS OF THE ATTRIBUTION PROCESS

INTRODUCTION

Attribution is the process by which individuals explain the behaviour of others or themselves. It is usually based on two possible explanations (sometimes called the "locus of causality"; Buchanan et al 2007):

- Internal attributions - Something about the individual causes the behaviour, like personality characteristics (eg: success in an examination is due to high intelligence);

- External attributions - Something outside the individual causes the behaviour, like the environment or other people (eg: failure in an examination was due to difficult questions).

Attribution is how the individual makes sense of behaviour not necessarily the real cause of the behaviour.

LAU AND RUSSELL (1980) STUDY

Lau and Russell (1980) were interested in the attribution process in relation to success and failure by individuals. One of the best situations to use for this is professional sport. Rather than individuals just attributing success or failure in a neutral sense, there is evidence of motivational or hedonic bias.

Individuals who win tend to make an internal attribution for their success (self-enhancing attribution)(eg: "I won because I am a good player"), but make an external attribution for losing (self-protecting attribution)(eg: "I lost because of bad refereeing decision")(Miller and Ross 1975).

Lau and Russell looked at thirty-three major sporting events as reported in eight daily newspapers in the USA in autumn 1977. A total of 594 explanations for winning and losing were found from coaches, players , and sportswriters in 107 articles. The study used content analysis methodology.

The explanations for winning or losing were coded as follows:

- Internal or external attribution for success or failure;

- Stability of attribution - A temporary/unstable cause (eg: bad luck) or a stable one (eg: good player).

Table 1 gives examples of the coding in relation to baseball.

	INTERNAL	EXTERNAL
STABLE	"Piniella has done it all" (Coach talking about	"It took a great team to beat us, and the Yankees definitely are a great team"
UNSTABLE	"You're supposed to keep the ball in on him. Well we didn't"	"I think we've hit the ball all right. But I think we're unlucky"

Table 1 - Examples of types of coding from baseball (Lau and Russell 1980 p32).

The results showed a significant difference in the predicted direction using chi squared. The majority of attributions of the winning team were internal and external for the losing team (table 2).

	WIN	LOSE
INTERNAL ATTRIBUTION	74.9	45.1
EXTERNAL ATTRIBUTION	25.1	54.9

Table 2 - Type of attribution (%) and win or lose.

The players and coaches themselves showed a stronger internal attribution for winning than sportswriters (80.3% vs 42.9% internal attribution), but less of a difference for losing (47.2% vs 42.9% external attribution respectively).

In relation to stable-unstable, the majority of attributions were unstable irrelevant of winning or losing (eg: concentration dropped or "making a spectacular play").

EVALUATION

1. Use of real-life data compared to laboratory-based experiments with students (eg: Jones and Davis 1965) using "hypothetical and fairly trivial situations".

"These attributions are almost always recorded on forced-choice, close-ended scales. Therefore, the type of attributions that can be made (and even whether or not to

make attributions at all) is generally determined by the experimenter" (Lau and Russell 1980 p29).

Also professional sport includes "high levels of involvement.. rarely achieved in the laboratory" (p30).

2. The data were collected by eight undergraduates, working in pairs, trained to look for explanations of the outcome of a game. This was "blind" coding as the undergraduates did not do the coding of attributions. This was done by Lau and Russell themselves independently. They achieved around 90% agreement on categorisation of attributions.

Each article was copied separately onto a card, so surrounding information did not influence the coding process. But it meant that the articles were out of their natural context in the newspapers.

3. The attributions made were public, but did they represent the "real" beliefs of the players and coaches? Lau and Russell felt that "Although we have no means of assessing private attributions, the answer to this question is most certainly no in some instances and yes in others" (p35).

4. Problems with coding free responses into simple categories. For example, "the issue of what is internal and what is external is not always evident" (Lau and Russell 1980 p36). The statement, "They played better than us", could be coded as either internal (our play was poor) or external (their play was better).

5. This study was a quantitative content analysis using archival/historical data. Table 3 lists the advantages and disadvantages of such a method.

ADVANTAGES

1. Gives researcher control over the data collected and used.

2. More ecological validity than laboratory experiments.

3. Unobtrusive, and so no ethical issues related to this.

4. Low cost compared to setting up experiment.

5. Quick results compared to full-scale study.

DISADVANTAGES

1. Dependent on content of newspaper articles; cannot change or add material.

2. Researchers interpret the material and this may be different to what original authors meant.

3. Reliability and validity of categorisation process.

4. Free responses are forced/reduced into simple categories for numerical scoring (ie: qualitative to quantitative data).

5. Cannot establish causality as with the experiment.

Table 3 - Advantages and disadvantages of quantitative content analysis.

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THE PARTICIPANT IN THE EXPERIMENT

DEMAND CHARACTERISTICS AND THE "GOOD PARTICIPANT"

> It has long been recognised that certain differences will exist between the types of experiments conducted in the physical sciences and those of the behavioural sciences because the former investigates a universe of inanimate objects and forces, whereas the latter deals with animate organisms, often thinking, conscious subjects [5] (Orne 1962 p776).

The experiment in psychology is different to the physical sciences because the object of study is not a passive responder to stimuli. The participant is actively involved in "a special form of social interaction known as 'taking part in an experiment'" (Orne 1962).
So:

> Just about any request which could conceivably be asked of the subject by a reputable investigator is legitimized by the quasi-magical phrase, 'This is an experiment', and the shared assumption that a legitimate purpose will be served by the subject's behaviour (Orne 1962 p777).

Orne (1962) asked participants to complete a series of additions of random digits - 224 on each sheet and 2000 sheets given to each participant. The participants continued until the experiment was stopped after five and a half hours. In the desire to find tasks that participants would refuse to do, Orne got them to do the same additions as above, but after each sheet to pick up a card with instructions. Every card read:

> You are to tear up the sheet of paper which you have just completed into a minimum of thirty-two pieces and go on to the next sheet of paper and continue working as you did before; when you have complicated this piece of paper, pick up the next card which will instruct you further. Work as accurately and as rapidly as you can (p777).

Participants continued with the task for hours despite it being meaningless. Post-experimental interviews found that participants made sense of the experiment as an endurance test. This behaviour of compliance towards the demands of the experimenter goes with the expectations that participants have of experiments generally and that particular experiment.

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[5] The term "participant" is used today, but "subject" was the common term in the past for those individuals who took part in experiment.

Orne and Scheibe (1964) formally showed the power of expectations by the participants. The task was related to sensory deprivation, and participants were asked to stay in a well-lit but bare room for four hours alone without time cues. Performance on cognitive tests were taken before and after the experiment.

One group were told that they were the control group in an experiment on sensory deprivation, while the other group just did the experiment. One other difference was the presence of a "panic button" in the latter condition, but not in the control group. Despite more or less the same experimental conditions, the control group showed significantly less decline of cognitive performance over the four hours. The control group participants were told that they were the control group and so behaved as if nothing would happen (ie: no expected decline in cognitive performance from sensory deprivation).

Without direct instructions to do so, the participant changes their behaviour to fit in with the expectations of the social situation that is the experiment. But the experimenter wants to discover the participant's typical behaviour.

The participant in the experiment is a thinking individual who is trying to make sense of the experiment, and the social situation. In a memory experiment, they are not just remembering the words, but trying to understand what is happening in a social sense.

For volunteer participants, in particular, there can be a shared belief with the experimenter that "whatever the experimental task is, it is important, and that as such no matter how much effort must be exerted or how much discomfort must be endured, it is justified by the ultimate purpose" (Orne 1962 p778). This produces the tendency for the participant to be a "good participant".

But experimenters try to hide details of the experimental hypothesis from the participants for good experimental practice. This leads the participant to look for cues that tell them what that hypothesis is. Orne first labelled these cues the "demand characteristics of the experimental situation" at the American Psychological Association conference in 1959 (Orne 1962).

Demand characteristics cannot be removed because human participants will always make sense of the experimental situation, so it is necessary to take them into account. One way is to use post-experimental interviews to understand what the participant was thinking during the experiment.

It is important to note that Orne (1962) was not arguing against the usefulness of the experiment rather how to perfect the experimental design. However, he did highlight a factor that does limit the accuracy of

traditional laboratory experiments.

ALTERNATIVES TO THE "GOOD PARTICIPANT"

Orne concentrated upon the participant as "good participant", but subsequent researchers have suggested that this is not always the case. Participants may change their behaviour in the experiment but not necessarily always to aid the experimenter. Weber and Cook (1972) distinguished four roles that participants might take during an experiment:

- "Good subject" - This fits Orne's (1962) idea of the participant who wants to validate the experimental hypothesis;

- "Faithful subject" (Fillenbaum 1966) - This is "someone who believes that a high degree of docility is required in research settings and who further believes that his major concern should be to scrupulously follow experimental instructions and to avoid acting on the basis of any suspicions he might have about the true purpose of a study" (Weber and Cook 1972 p275).
  The passive version assumes a docile participant, while the active version assumes a participant motivated to help science (Weber and Cook 1972);

- "Negativistic subject" (Cook et al 1970) - This is also called the "recalcitrant subject" (Fillenbaum and Frey 1970) or the "screw you" effect (Masling 1966). There is hostility towards the experiment and the experimenter, and the participant seeks to understand the purpose of the experiment in order to give unhelpful replies;

- "Apprehensive subject" (Riecken 1962) - This is sometimes called "evaluation apprehension", and participants are motivated to present themselves in the best light, so they try extra hard to get a better score on tests.

After a review of the literature of the time, Weber and Cook (1972) felt that the most likely response of participants was the "apprehensive subject" or "evaluation apprehension". However the participant changes in the experiment, they are not behaving as they would in real life. It could lead to a very cynical position that all the experiment tells us is how individuals behave in experiments.

It should also be remembered that the experiment takes place in a social context. The experiment in 1950 or 1960 is a different event to the experiment in the

21st century. It will mean that participants behave differently today in experiments compared to the past, but whether that is more or less helpful, or whether demand characteristics or the "screw you" effect is more important is open to debate. The point again is that individuals in an experiment are not behaving as they behave in the real world, and that is the issue.

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